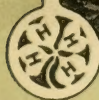
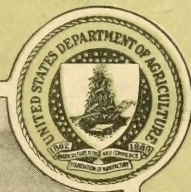


BOYS' AND GIRLS' CLUB WORK



Diseases & Insects of the Home Garden



United States Department of Agriculture
And State Colleges of Agriculture Cooperating

Department Circular 35

CONTENTS

	Page		Page
General crop pests.....	3	Principal insects and diseases that attack gar-	
Cutworms.....	3	den crops—Continued.	
Wireworms.....	4	Four-spotted bean weevil and cowpea wee-	20
Blister beetles.....	4	vil.....	21
Grasshoppers.....	4	Pea aphid.....	21
Red spiders.....	4	Potato.....	21
Slugs and snails.....	5	Scab.....	21
Damping off.....	5	Early-blight.....	22
Principal insects and diseases that attack gar-		Late-blight.....	22
den crops.....	5	Tip burn.....	22
Beans.....	5	Wilt.....	22
Pod-spot or anthracnose.....	5	Colorado potato beetle.....	23
Blight.....	5	Blister beetles.....	23
Weevils.....	6	Flea-beetles.....	23
Bean-leaf beetle.....	6	Sweet potatoes.....	24
Bean aphid.....	7	Black-rot.....	24
Beets.....	7	Stem-rot.....	24
Leaf-spot.....	7	Foot-rot.....	24
Flea-beetles.....	7	Tortoise beetles.....	24
Beet webworm.....	8	Flea-beetles.....	25
Cabbage.....	8	Tomato.....	25
Black-rot.....	8	Leaf-spot.....	25
Yellows.....	9	Wilt.....	25
Black-leg.....	9	Blossom-end rot.....	25
Club-root.....	10	Tomato hornworms.....	25
Common cabbage worm.....	10	Tomato fruitworm.....	26
Cabbage looper.....	11	Flea-beetles.....	26
Harlequin cabbage bug.....	11	How to make fungicides and insecticides.....	27
Plant-lice.....	11	Fungicides.....	27
Flea-beetles.....	12	Bordeaux mixture.....	27
Cabbage maggot.....	12	Formaldehyde.....	28
Cucumbers, muskmelons, and squashes.....	13	Insecticides.....	28
Wilt.....	13	Lead-arsenate.....	28
Mosaic.....	13	Other stomach poisons.....	29
Anthracnose.....	14	Nicotine sulphate.....	29
Downy mildew.....	14	Kerosene emulsion.....	29
Leaf-spot.....	15	Soap sprays.....	29
Striped cucumber beetle.....	15	Lime.....	29
The twelve-spotted cucumber beetle.....	16	Flowers of sulphur.....	29
The melon aphid.....	16	How to spray.....	29
The common squash bug.....	17	Spraying and dusting tools.....	30
The squash-vine borer.....	17	Miscellaneous control methods.....	30
Onions.....	18	Soil treatment.....	30
Smut.....	18	Carbon disulphid.....	30
Onion thrips.....	19	Trap crops.....	31
Onion maggot.....	19	Insect friends.....	31
Peas.....	19	Ladybird beetle.....	31
Pod-spot.....	19	Syrphus fly.....	31
Pea weevil.....	19		

Contribution from the States Relations Service
(Office of Extension Work North and West)
A. C. True, Director

RECEIVED
NOV 17 1933
DIVISION OF DOCUMENTS

SB603
G5
An. P. 12. F. 34

DISEASES AND INSECTS OF THE HOME GARDEN

W. W. GILBERT, *Pathologist, Bureau of Plant Industry*, and C. H. POPENOE,
Assistant Entomologist, Bureau of Entomology

FROM THE TIME the seeds of garden crops are put into the ground until the crops are gathered, diseases and insects may appear that must be fought. The gardener who starts with a clean soil has done much to keep out insects and diseases, and thus save the trouble and cost of applying sprays. "Prevention is better than cure," especially in the home garden, which usually must be planted on the same ground year after year. Many diseases and insects live over winter in the soil and will appear on the plants again next season if they are put in the same place. One of the best ways to help get rid of such troubles is to plant each vegetable in a different part of the garden every year.

Some of the worst garden troubles are brought in on roots of plants, and remain in the soil to attack the next crop, consequently in buying plants of any kind, one should be sure they are healthy and free from insects. The roots should be clean and hairy, not swollen or knotty.

In giving ways of controlling insects and diseases in the following pages, they are grouped under two headings, treatment and prevention.

Treatment means the use of methods of control which may be applied after the diseases or insects have appeared in the garden, such as hand-picking of insects, or spraying for diseases and insects.

Prevention means the use of such methods of control as will prevent the development of insects or diseases, or their being carried over to crops the next year, such as burning sick plants, the use of seed free from disease, treatment of seed to kill insects and diseases, or the planting of crops on parts of the garden free from disease.

Injurious insects may be divided into two classes. First, those which ordinarily attack only one crop or crops of one kind. The large tomato worm, which confines its feeding to the plants of the tomato and potato family, is an example of this class. The second class eats nearly every kind of plant that grows in the garden. Cutworms, several other caterpillars, several kinds of leaf-beetles, flea-beetles, plant-lice, thrips, and blister beetles are examples of this class.

GENERAL CROP PESTS

CUTWORMS.—Cutworms appear in great numbers in the early spring and summer, and plants may be killed before the gardener notices their presence. The main injury done is the cutting off of the stems of young plants at the surface of the ground. One cutworm can kill many plants in one night.

Treatment.—The best remedy is poisoned bait. This can be made for use in a small garden by thoroughly mixing 2 level tablespoonfuls of white arsenic or paris green into 5 pounds of dry bran. Then add from 4 to 6 quarts of water in which a half pint of sorghum or cheap

molasses has been mixed. After the mash has stood for several hours, scatter it thinly over the garden or about the bases of the plants that have been set out. Put out the poison late in the day so that it will be moist during the night when the cutworms feed. Do this two or three times if the cutworms continue to cut the plants.

ARSENIC and paris green are deadly poisons. Handle them with great care. Keep young children, live-stock, and chickens away from this bait.

Cutworms can be gathered by hand. Dig into the ground around the plants that have been cut off and the gray smooth cutworms will usually be found curled up about an inch below the surface of the ground. Sometimes several may be found around one plant.



FIG. 1.—Bean anthracnose on pod and seeds.

some are gray, and others are gray spotted with black.

Treatment.—When the beetles are first seen, spray with lead arsenate (see page 23). Hand-picking is somewhat dangerous unless gloves are worn, as the beetles may blister the tender skin.

GRASSHOPPERS.—Grasshoppers are often troublesome to vegetables.

Treatment.—Use the same bran mash as for cutworms (see page 3), adding one finely chopped orange or lemon to the water before mixing.

RED SPIDERS.—Nearly all vegetables are attacked by what are

WIREWORMS.—Wireworms are common pests in the garden. They are long, slender, hard, brown worm-like larvæ, the young of snapping beetles or “snap bugs.” They attack and often do great damage to potatoes, carrots, beets, sweet potatoes, and onions.

Prevention.—Deep midsummer cultivation and heavy fertilizing will reduce wireworm damage.

BLISTER BEETLES.—Blister beetles are common farm pests and are very destructive to vegetables, especially peas, beans, potatoes, and beets. They travel like army worms, and for this reason are sometimes called army beetles. They are hungry feeders, and often travel in lines, eating everything in their path. They are slender in form, somewhat soft-bodied, and of many colors. Some are entirely black, some are yellow with black stripes,

commonly called red spiders. This is not a true spider, but a mite, and is so small that it can hardly be seen. It injures plants by sucking the juices, and when plants are neglected their strength is slowly lost and in time they die. In case of a bad attack, great numbers of the mites can be found on the leaves, and the webs which the insects spin from plant to plant can be seen with the mites themselves passing rapidly over them and gathering in swarms. Sometimes the plants look as though scorched by fire.

Treatment.—Spraying with soap and water (see page 29) or kerosene-soap emulsion (see page 29) is a good remedy. Another is spraying with flowers of sulphur mixed with water. (See page 29.) Watch for these pests, and spray when they first appear, as it is hard to save the plants after they are covered with the webs.

SLUGS AND SNAILS.—Much harm is done by slugs—soft, slimy animals which look like snails without shells. They are black, gray, or brown, usually spotted with black, and grow to be 5 or 6 inches long. Snails also are sometimes troublesome. Attack is worst on young plants grown in hotbeds and cold frames. Tender garden vegetables of nearly all kinds are also injured by snails and slugs out of doors.

Treatment.—The best remedy is air-slaked lime (see page 29) sprinkled over the plants and scattered about the garden. When the lime gets on the slugs, they throw off so much slime that they become weakened and die. Other remedies are soot, road dust, and sifted wood ashes. A strip of soot or wood ashes around the garden will keep the slugs away.

Prevention.—To avoid slugs, remove all rotten wood and old structures and keep the entire garden and yard free from rubbish of all kinds.

DAMPING-OFF.—When seeds of tomato, cabbage or other vegetables are planted in small boxes in the house to raise early plants for setting in the garden, a disease called “damping-off” often causes much trouble. Small plants may suddenly fall over and die, or black dead areas may appear on the stems near the soil, which dwarf or kill the plants.

Treatment.—Give the plants plenty of air and light and water moderately early in the morning.

Prevention.—The best method of preventing damping-off and root troubles which may attack small plants is to treat the soil in the seed box with boiling water a few days before planting the seeds. (See page 30.) This will kill the diseases and insects present.

PRINCIPAL INSECTS AND DISEASES THAT ATTACK GARDEN CROPS

BEANS

POD SPOT or ANTHRACNOSE.—Most gardeners recognize anthracnose by the roundish sunken spots with reddish edges which it causes on the young pods (fig. 1). It also makes red spots on the stems and leaf veins, and grows through the pods and causes rusty looking sores on the ripe seeds. The disease lives over winter on the seeds.

Prevention.—See blight below.

BLIGHT.—Bean blight shows on the pods first as water-soaked looking spots. These later become rust colored. On the leaves it causes large

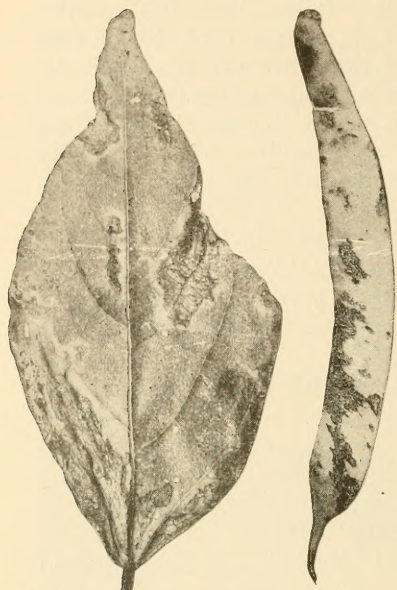


FIG. 2.—Bean blight on leaf and pod.

ruin a crop of beans for either human food or seed. Several broods may be produced in a year.

The common bean weevil is dull gray with reddish legs and is about one-eighth of an inch long.

Treatment.—Bean weevils cannot be controlled in the field. They breed in dry seed and it is, therefore, best to harvest the crop, and as soon as dry to fumigate it with carbon disulphid. Carbon disulphid is explosive, so the club leader or parents should supervise the use of it, as explained on page 31.

Prevention.—Plant only seed free from weevils.

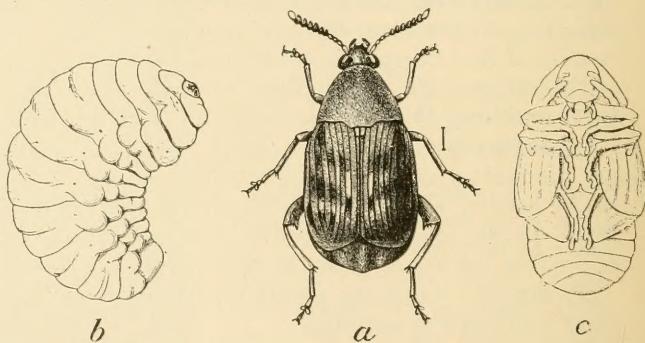
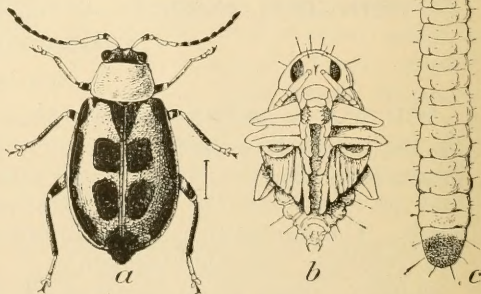
BEAN LEAF-BEETLE.—The bean leaf-beetle (fig. 4) does much injury in the Eastern States and from Ohio southward

patches to turn yellow, then brown, and die (fig. 2). This disease is also carried on the seed.

Treatment.—There is no successful treatment.

Prevention.—The best way to avoid both anthracnose and blight is to plant only healthy, unspotted seeds in a part of the garden where beans were not grown the previous year. Save seed for next year from pods free from spots.

WEEVILS.—The worst insect enemies of beans are weevils. Attack begins in the field, from eggs laid in a joint of the pod or an opening through which the egg is pushed. The eggs hatch into the larvæ, or grubs, which grow inside the bean and soon after the beans are harvested change to weevils and begin to come out (fig. 3). A second brood of the common bean weevil may be enough to

FIG. 3.—The common bean weevil: *a*, full-grown beetle; *b*, grub; *c*, pupa (sleeping stage). Greatly enlarged. The small straight line between *a* and *c* shows length of a full-grown weevil.FIG. 4.—The bean leaf-beetle: *a*, full-grown beetle; *b*, pupa; *c*, grub. Greatly enlarged. Small straight line between *a* and *b* shows length of full-grown beetle.

to Louisiana. The beetles eat large round holes in the growing leaves. They also feed on such wild plants as beggarweed or tickseed. The grubs feed on the roots and main stems just below the ground, their habits being much the same as those of the better known cucumber beetles.

Treatment.—Lead arsenate is the best remedy for this insect. On young beans it must be applied at half strength in order not to burn the plants. Directions for mixing this poison are given on page 28.

BEAN APHIS.—The bean aphid is a very small, blackish plant-louse which does damage in all parts of the United States, being very troublesome in California, where it works on the early plants.

Treatment.—Nicotine sulphate (see page 29) is the best remedy if put on as soon as the plant-lice are first seen and again later, if found necessary.

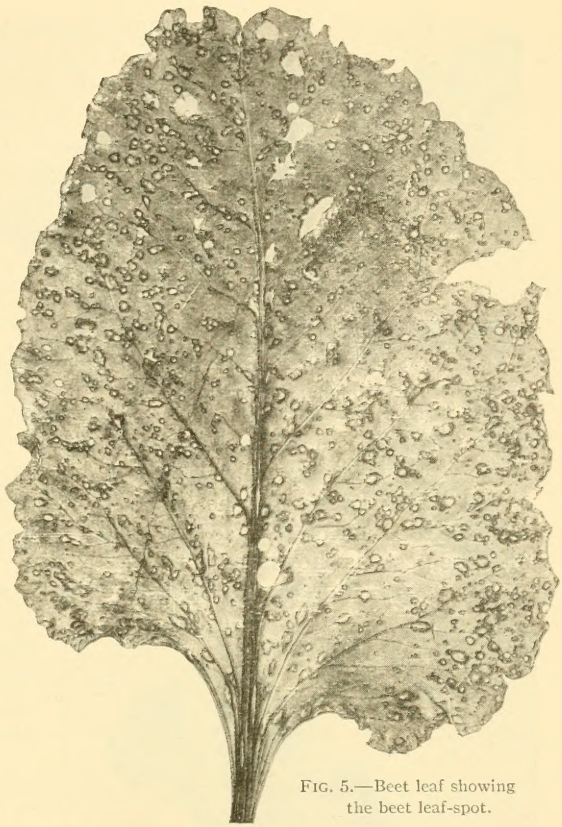


FIG. 5.—Beet leaf showing the beet leaf-spot.

BEETS

LEAF-SPOT.—In leaf-spot numerous small, dead spots are present on the leaves. These spots are roundish and have a white center and a purple edge (fig. 5).

Treatment.—The trouble can be controlled by spraying with Bordeaux mixture (see page 27). Begin to spray when the disease appears and repeat every 10 days until the end of the season.

FLEA-BEETLES.—The beet flea-beetle (fig. 6), also called the spinach flea-beetle, is very injurious to table beets, attacking them as soon as they are above the ground. The young, or larvæ, grow on chickweed and pigweed, and a second brood attacks the beets. The young

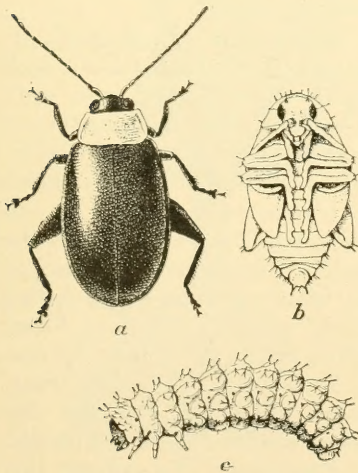


FIG. 6.—The beet flea-beetle: a, beetle; b, pupa; c, full-grown grub. Greatly enlarged.

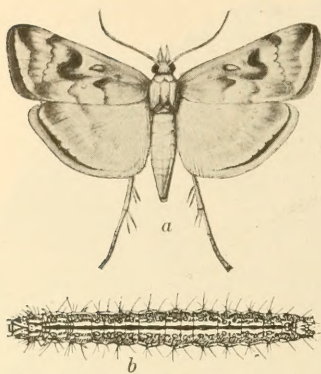


FIG. 7.—Beet webworm: *a*, moth; *b*, full-grown larva. Enlarged.

early spring. Cutworms also feed on these weeds.

BEET WEBWORM.—Several kinds of webworms attack beets by eating the leaves, which become webbed together on the growing plant. The worst of these pests is shown in figure 7.

Treatment.—Spray with arsenate of lead, made as described on page 28.

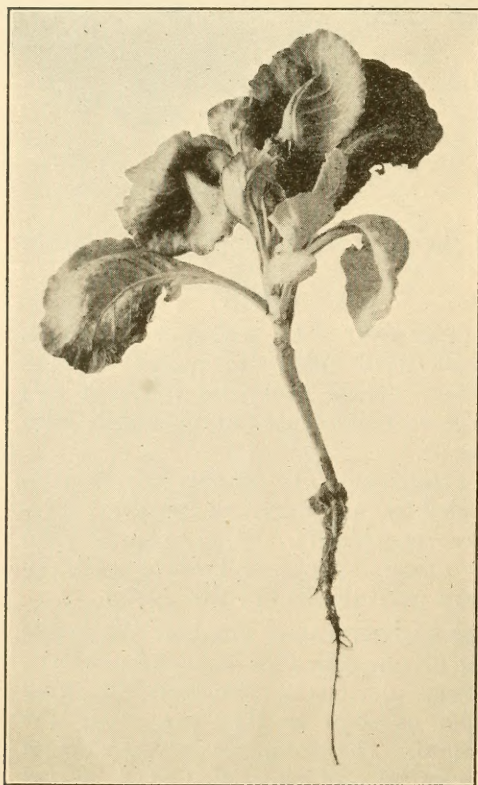


FIG. 9.—This cabbage plant is one-sided, stunted, and the leaves curled because of yellows.

sometimes become so thick as to destroy entire rows of beets before the insects are even seen by the gardener. They even work down and bore into the crowns of the plants.

Treatment.—This insect can be kept down readily by spraying with arsenate of lead (see page 28) when the pest is first seen, and again as often as needed.

Prevention.—Chickweed and pigweed (lamb's-quarters) are the natural food plants of the flea-beetle, and should be killed in the

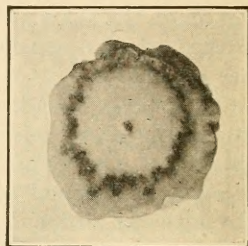


FIG. 8.—Cabbage black-rot. Slice across a diseased stem to show the black ring which the disease causes.

Prevention.—The garden should be kept free from such weeds as pigweed, since these encourage webworms and help them to spread.

CABBAGE

The diseases which attack cabbage also attack other plants of the cabbage family, such as cauliflower, brussels sprouts, and turnips.

BLACK-ROT.—Cabbage plants attacked by the black-rot look sickly and do not grow well. They usually have yellowed leaves with blackened veins. The inside of the stem shows a blackened ring (fig. 8) and the heads frequently rot in the field. Plants may be attacked by black-rot at any time during their growth. Serious losses often result from this disease.

Treatment.—There is no treatment which will stop the disease. Pull and burn sick plants.

Prevention.—To prevent this trouble soak the seeds for 15 minutes, just before planting, in

a solution of 1 teaspoonful of formaldehyde to 1 quart of water. (See page 28.) Plant in soil free from black-rot. Set the plants in a part of the garden which has not been in cabbage or any other plant of the cabbage family for a year or more.

YELLOWS. — Yellows or wilt attacks the plants while small, and causes a black ring in the stem, like black-rot. The plants turn yellowish-green, but unlike black-rot the leaves fall off. Often one-sided leaves or plants are found (fig. 9). Many plants attacked dry up and die young, and very few sick plants form

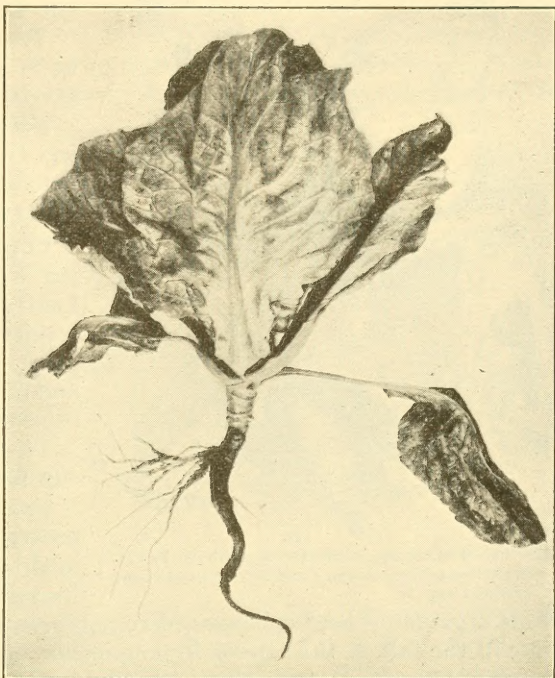


FIG. 10.—Black-leg makes the cabbage stem turn black and stunts the entire plant. A few feeble side roots are developed above.

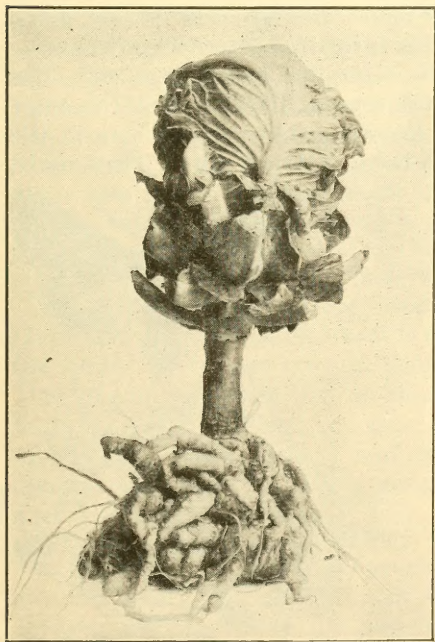


FIG. 11.—Cabbage plant with large knotted roots caused by club root.

heads. In many localities wilt is the most important cabbage disease and does a great amount of damage.

Treatment.—None.

Prevention.—The use of varieties which do not have this disease is the best method of prevention. If possible, set healthy young plants in a part of the garden where the disease has not appeared.

BLACK-LEG.—Black-leg may attack cabbage plants while they are very small, often in the seed bed. The disease gets its name from the fact that the stem of the plant rots and turns black (fig. 10). It also causes dark spots on the leaves. These dead spots are later covered with tiny black pimples. In the early stages of the disease, the leaves often turn purple. Later the whole plant wilts and the tips of

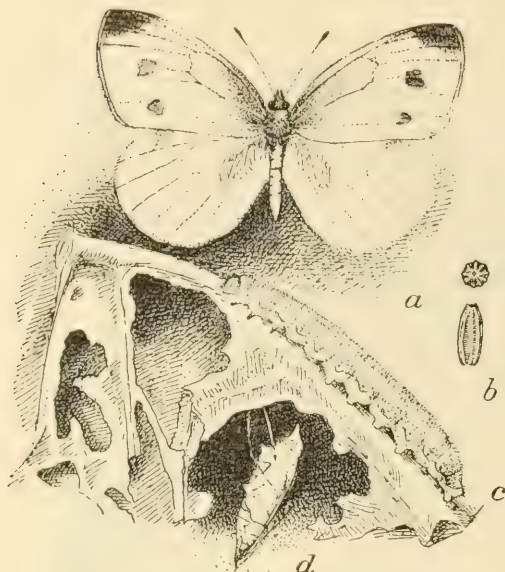


FIG. 12.—The common cabbage worm: above, butterfly; below, cabbage worm, *c*, and chrysalis, *d*. Greatly enlarged egg, *b*.

of the garden where cabbages have not been grown. Apply air-slaked lime in the fall, at the rate of 40 pounds per square rod, to the soil where the disease was. Destroy diseased plants. Do not put them on manure or compost piles.

COMMON CABBAGE WORM.—This worm and the white butterfly are known to most persons, but in some cases growers do not know that the velvety green caterpillar turns into the butterfly and that the butterfly lays the eggs from which the caterpillar comes (fig. 12). The cabbage worms begin work early in the season. After eating the outer leaves, they attack the tender inner leaves as they form, hiding in the young heads where it is hard to reach them with a spray. They make the cabbage heads unfit for food, partly by leaving them in a filthy condition. In cool weather the caterpillars often feed on the upper surface of the leaves, and at such times they are easily killed. The butterflies occur from March to October, and the worms are at work from April to September, and later.

The cabbage worm also feeds on cauliflower, kale, collards, turnips, radishes, and horse-radish.

Treatment.—Spraying with arsenate of lead (see page 28) is the best remedy. Add a $\frac{1}{2}$ -inch cube of laundry soap to each pint of lead arsenate spray when spraying cab-

the leaves rest on the ground.

Treatment.—No effective treatment is known. Pull and burn the sick plants at once.

Prevention.—To prevent black-leg, treat the seeds with formaldehyde and follow the directions given under black-rot on page 8.

CLUBROOT.—Clubroot makes the roots grow very large and knotty (fig. 11) and keeps the heads very small. Diseased plants look stunted and yellow and often wilt in the sun and fail to produce a crop.

Treatment.—There is no remedy for sick plants.

Prevention.—The best way to prevent this trouble is to set out healthy plants grown in disease-free soil (see page 30) in a part



FIG. 13.—The cabbage looper: above, moth; below, young looper and chrysalis. Enlarged.

bage, otherwise the spray is not likely to stay on well. While the spray leaves a coating on the outer leaves until late in the season there is no danger, as the outer leaves are always removed before cooking, and whatever trace of the arsenic might remain on the inner leaves is not sufficient to be injurious. Hand picking the worms will also help.

Prevention.—The clearing up and burning of all such weeds as mustard, shepherd's purse, pepper grass, etc., before planting cabbage plants will help keep down the number of worms. Destroy all injured plants and stalks by burning as soon as the main crop is harvested.

CABBAGE LOOPER.—The cabbage looper is the young, or worm, of a medium-sized gray moth (fig. 13). It is pale green and delicate looking when first hatched.

When larger, it becomes striped, and gets its name of looper by its habit of doubling up, or looping, as it walks. It eats all kinds of cabbage-like plants, and sometimes peas, beets, celery, and lettuce, and even attacks tomato and potato.

Treatment.—Same as for common cabbage worm.

Prevention.—Same as for common cabbage worm.

HARLEQUIN CABBAGE BUG.—The harlequin cabbage bug, also called the calico bug, fire bug, or terrapin bug, is about half an inch long and red, spotted with black. It is a southern insect commonly found from Virginia to California, but often works northward.

Treatment.—The best spray for this pest is nicotine sulphate (see page 29). The newly hatched young are much more easily killed than the harder, full-grown bugs. Hand pick the full-grown bugs and eggs early in the season. The eggs look like little black-banded barrels on end, and are placed in clusters on the under side of the leaves.

Prevention.—Clean culture, especially in the fall, and planting trap crops (see page 31) of mustard or other plants of the cabbage family in the spring will help to prevent damage by this insect.

PLANT-LICE.—Plant-lice of three kinds, the cabbage louse, turnip louse, and spinach louse, do much damage to cabbage. These insects are very small, soft bodied, and greenish or yellowish in color (fig. 14). They appear early in the spring, and sometimes remain as late as December.

Treatment.—The best remedy is nicotine sulphate (see page 29). Kerosene emulsion and soap (see page 29) are also good. Washing down the plants with a strong stream of water from a syringe, garden hose, or a sprayer, will often keep this pest from killing them. Treatment should be given the plants when the pests are first seen.



FIG. 14.—The spinach louse, showing full-grown louse and young ones. Greatly enlarged.

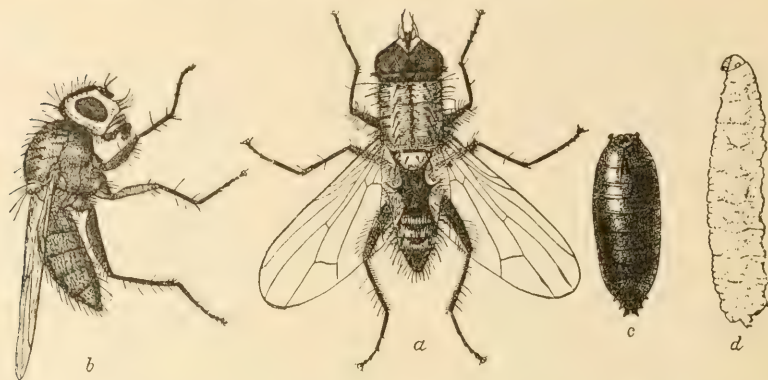


FIG. 15.—The seed-corn maggot: *a*, back view of fly; *b*, side view; *c*, puparium; *d*, maggot. Greatly enlarged.

Prevention.—Keep the garden clean of weeds on which plant-lice feed.

FLEA-BEETLES.—Flea-beetles attack young cabbages, radishes, and turnips. These are usually greenish or bluish black in color. They are a little larger than fleas, and have the same jumping habit.

Treatment.—Use lead arsenate as for cabbage worms. Bordeaux mixture, as described on page 27, with two 1-inch cubes of laundry soap added, is an excellent spray to drive these insects off the plants.

CABBAGE MAGGOT.—Cabbage and related crops often suffer badly from the attacks of the cabbage maggot which looks like the seed-corn maggot shown in figure 15. The parent of this maggot looks like the common house fly. Young plants are worst attacked, the maggots gnawing off the outer surface of and boring into the larger roots, eating the tender smaller roots and often boring into the lower part of the stalk. When very common, the cabbage maggot is one of the hardest pests to control.

Treatment.—Hand picking, although hard work, will prevent damage. It consists of pulling up the young cabbage or cauliflower plants, looking over the roots for eggs and maggots, and destroying them by crushing with the hand or washing the roots in a strong solution of soap, then replanting. Usually the plants show no bad effects from this treatment after two or three weeks. By

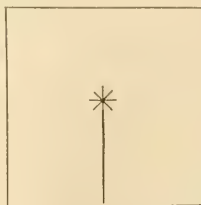
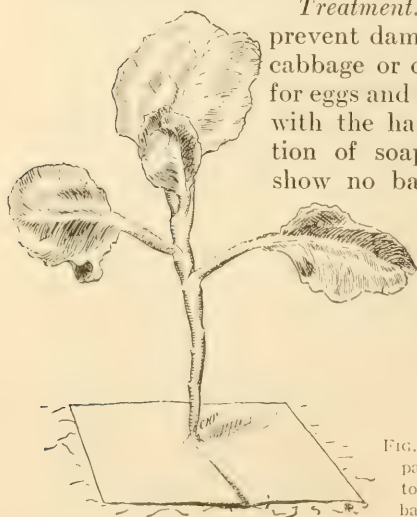


FIG. 16.—Showing how tarred-paper pads are made and used to keep root-maggots from cabbage plants.

looking closely, the little white eggs may be seen about the stalks of young cabbages, and if the earth is raked away so as to expose the eggs to the sun they will dry up and not hatch. Keeping the

soil well hilled around the plants causes more roots to grow, so that the plants can live even if some of the roots are eaten off.

The use of squares or disks of tarred paper to protect the plants against the egg laying of the fly works well in small gardens. To make

the protectors, cut 3-inch squares of tarred building paper, make a slit from one side to the center, and several short slits like a star at the center (fig. 16). Place the square around the plant just before setting out and press the paper closely around the stem and down against the ground. The squares must fit tightly to keep out the fly.

Prevention.—Destroy all old plants by burning in the fall.

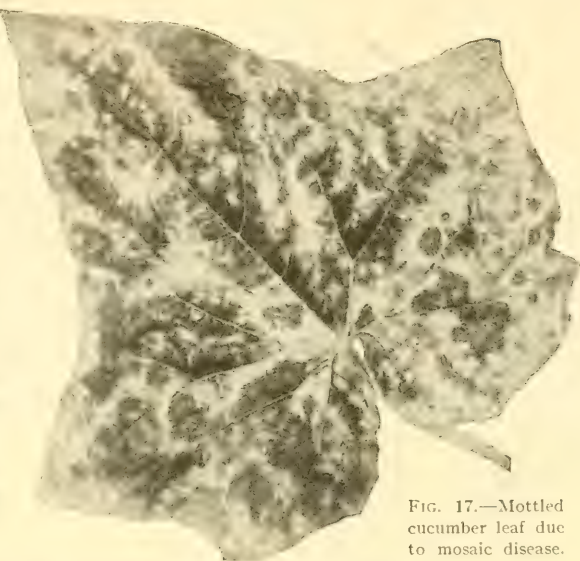


FIG. 17.—Mottled cucumber leaf due to mosaic disease.

CUCUMBERS, MUSKMELONS, AND SQUASHES

WILT.—Small cucumber and squash plants usually wilt, dry up, and die very quickly when attacked by this disease. The trouble affects the stem, and prevents the plant from getting water. Larger plants may lose runners one at a time until the entire plant is dead. In northern regions, this trouble is usually most common in July.

Treatment.—As the disease is carried by cucumber beetles, protect the plants as long as possible with cheesecloth covered cages to keep the beetles off (see fig. 22, p. 15). Pull plants having the wilt at once and bury or burn them. Remove the cages when the plants become too large, and if beetles are still abundant spray with Bordeaux mixture and lead arsenate (see pp. 27 and 28) every ten days.

MOSAIC.—Cucumber, muskmelon, and squash plants attacked by mosaic or white pickle disease are stunted and have wrinkled or mottled leaves (fig. 17). The affected cucumber and

squash fruits are often crooked and covered with green warts (fig. 18), or they may be nearly white, and when badly diseased are not good to eat. Many affected muskmelons remain small and are not edible. Mosaic is spread from diseased to healthy plants by plant-lice and striped cucumber beetles and by pickers.

Treatment.—The plants should be kept

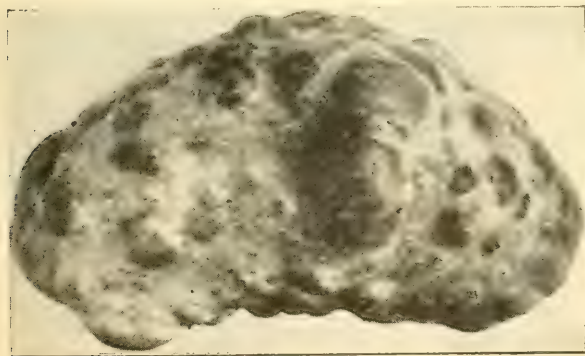


FIG. 18.—Warty cucumbers caused by mosaic or white pickle disease.



FIG. 19.—Cucumber anthracnose makes large brown, dead spots on the leaves.

covered as long as possible with cheesecloth cages to keep off the striped beetles (fig. 22). After the cages are taken off, the plant-lice and beetles must be kept off by dusts or sprays.

ANTHRACNOSE.—This disease of cucumbers is first indicated by roundish, brown, dead spots $\frac{1}{4}$ to $\frac{1}{2}$ inch wide on the leaves (fig. 19). On the stems it makes sunken, brown spots which finally kill them. Rotting of ripe cucumbers is often caused by this disease, and green fruits are sometimes attacked on the vines. The trouble usually

appears the latter part of the season. With warm, moist weather, it may kill the vines in a few weeks.

Treatment.—Anthracnose may be controlled in part by spraying the plants every week with Bordeaux mixture (see page 27). Begin to apply the spray about the middle of July, or whenever the vines begin to run.

Prevention.—Do not plant cucumbers on soil where cucumbers or muskmelons were grown the previous year.

DOWNY MILDEW.—This disease of cucumbers and muskmelons first appears on the leaves in late summer. It causes small, angular, yellowish spots. In moist, warm weather it makes the leaves curl up and die in a few days. The oldest leaves show the trouble first. The disease is often very bad in States along the Atlantic Coast.

Treatment.—Spraying with Bordeaux mixture (see page 27) will keep the plants from dying for two or three weeks longer than unsprayed plants. Begin to spray when the disease is first seen, or when the vines begin to run, and repeat once a week.



FIG. 20.—Muskmelon leaf-spot. Causes irregular, rusty-brown dead spots on the leaves, which soon curl up and die. It also attacks cucumbers.

LEAF-SPOT.—This trouble is most serious on muskmelons, but it also attacks cucumbers, particularly in the Western States. The leaves show irregular, brown, dead spots and on muskmelons they soon curl up and die (fig. 20). On cucumber leaves it causes dead areas which soon fall out, leaving ragged holes.

Treatment.—Spray with Bordeaux mixture as for downy mildew. (See page 14.)

STRIPED CUCUMBER BEETLE.—The striped cucumber beetle (fig. 21) as well as the twelve-spotted cucumber beetle (see page 16) live throughout the eastern part of the United States. In other States there are several

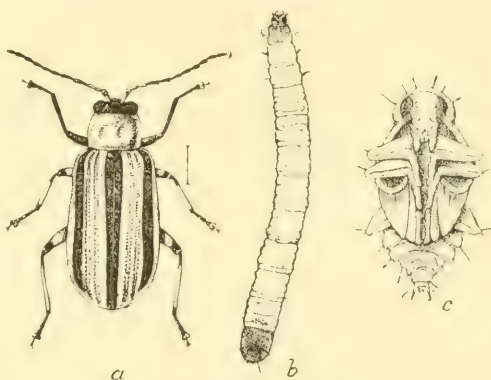


FIG. 21.—Striped cucumber beetle: *a*, beetle; *b*, root-worm; *c*, pupa. Small line at right of beetle is natural length.

other kinds of beetles having about the same habits and which can be treated in the same way. The common form in the East is known as the striped cucumber beetle, sometimes called the striped bug, melon bug, or "cuke bug." The beetle is about $\frac{1}{4}$ inch long and has three black stripes. The worm, or larva, is slender and white with brownish ends. Injury is done mainly by beetles which have lived through the winter eating the young plants in the spring. The beetles also injure older plants by eating the leaves and gnawing the stems and roots. They usually come out in April or May. Late in the season they gather around the stems and leaves of cucumbers and melons, but on the first cool nights in the fall they hunt for shelter. In the larval stage, this insect causes damage to the roots. The beetles also spread diseases of cucumbers, squash, and melons.

Treatment.—The simplest protection for garden use for this and other beetles is to cover the young plants with a cheesecloth-covered frame

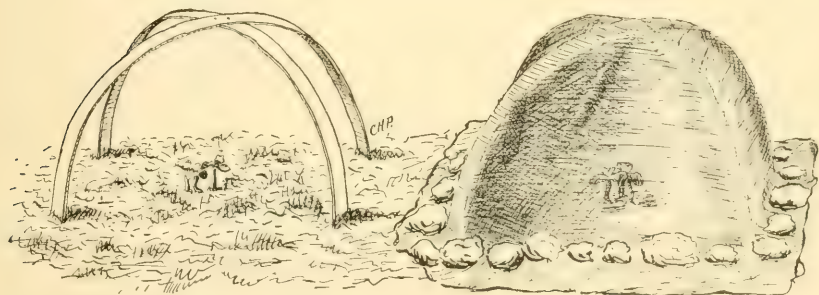


FIG. 22.—Barrel hoop and cheesecloth cover for cucumber and squash plants to keep insects off.

made by placing the halves of a barrel hoop, as shown in figure 22, and covering the frame thus made with cheesecloth. A good grade of cheesecloth must be used, as the beetles can easily go through a cheap mosquito-

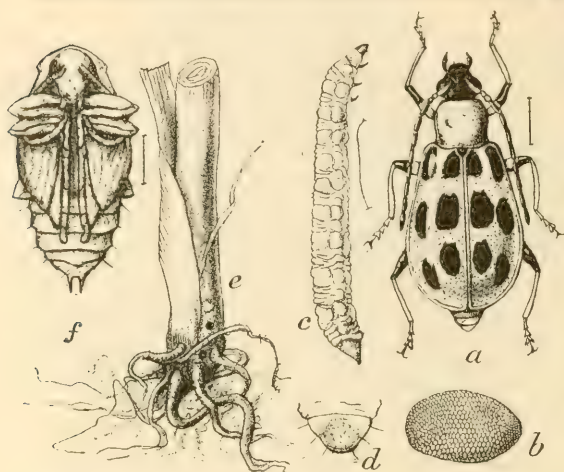


FIG. 23.—Twelve-spotted cucumber beetle: *a*, beetle; *b*, egg; *c*, root-worm; *e*, work of root-worm on corn root; *f*, pupa. Small lines at right show natural size.

netting, and a material heavier than cheesecloth keeps the light from the plants. The lower edges of the cloth must be held down tightly to the ground by stones or other weights or the beetles will burrow underneath. Cheesecloth-covered frames of any size and shape desired can be made from four 1-inch square corner pieces to which strips of lath are nailed.

Another method is to divide the hill into quarters, and each week plant in one of the quarters enough seed

for a full hill. In this way, even though the insects attack some of the plants, there will be enough left to give a crop. Arsenate of lead (see page 28), as used for the Colorado potato beetle, is the most effective remedy to use against this insect. Bordeaux mixture with lead arsenate added (see page 28) drives away the beetles and prevents injury to the leaves so treated.

THE TWELVE-SPOTTED CUCUMBER BEETLE.—The twelve-spotted cucumber beetle (fig. 23) is a little larger than the striped cucumber beetle. It often eats the cucumber leaves, causing much injury. The larva lives mainly on grasses and corn.

Treatment.—Spraying with lead arsenate (see page 23) and treating in the same manner as the striped cucumber beetle are the best remedies for this insect in small gardens.

THE MELON APHIS.—The melon aphis (fig. 24), commonly called the melon louse, is very small, and greenish, or nearly jet black. It injures cucumbers and many other plants by sucking their juices. It occurs from early spring and summer to late autumn and early winter. In seasons which favor its increase, par-

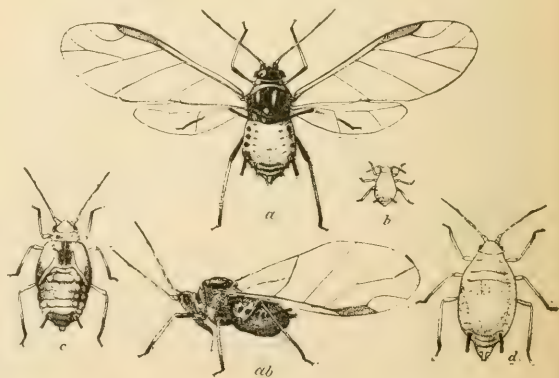


FIG. 24.—The melon aphis or louse, showing: *a* and *ab*, winged aphides; *b*, newborn young; *c*, nymph stage; *d*, wingless female. Much enlarged.

ticularly in summers following springs that are cool and rainy, it often appears in great numbers and does much damage, gathering in masses on the under side of the leaves of plants, and causing them to curl, shrivel, and lose color, and stopping the growth of the fruit. It often kills the plants outright. An attacked melon plant is shown in figure 25. The melon aphid, like others of its kind, gives off honeydew, a honey-like juice. When the aphids become very thick, the honeydew covers the leaves with a thin sticky coating on which the white skins of the plant-lice stick, and this attracts attention to the injury, as do also the wilting and dying of the plants.

Treatment.—The best remedy is spraying nicotine sulphate (see page 29).

THE COMMON SQUASH BUG.—Squashes, gourds, and pumpkins suffer from the same pests as cucumbers. If the plants escape the striped cucumber beetle and the melon aphid, they may be damaged by the squash bug (fig. 26, p. 18), commonly known as the stink bug from its disagreeable odor. Like the melon aphid, it feeds on the plant juices.

Treatment.—Hand picking before the insect lays its eggs is of value. The eggs, which are shiny brown, are easily seen on the under side of the leaves and can be crushed. Covering the plants as for beetles and using nicotine sulphate (see page 29) are helpful, but the full-grown bugs are hard to kill. They may be trapped by placing small pieces of board, shingle, or bark on the ground near the plants. The insects go under these pieces of wood to hide during the day. The traps should be examined each morning and the bugs found should be killed.

THE SQUASH-VINE BORER.—After cucumbers and melons have made good growth, they are sometimes attacked by the squash-vine borer (fig. 27, p. 18), which, however, is much more destructive to pumpkins and squashes, especially the Hubbard and summer bush varieties. This is the large white grub which bores through the stems, sometimes cutting them almost through near the roots.



FIG. 25.—Melon leaves curled by plant-lice.

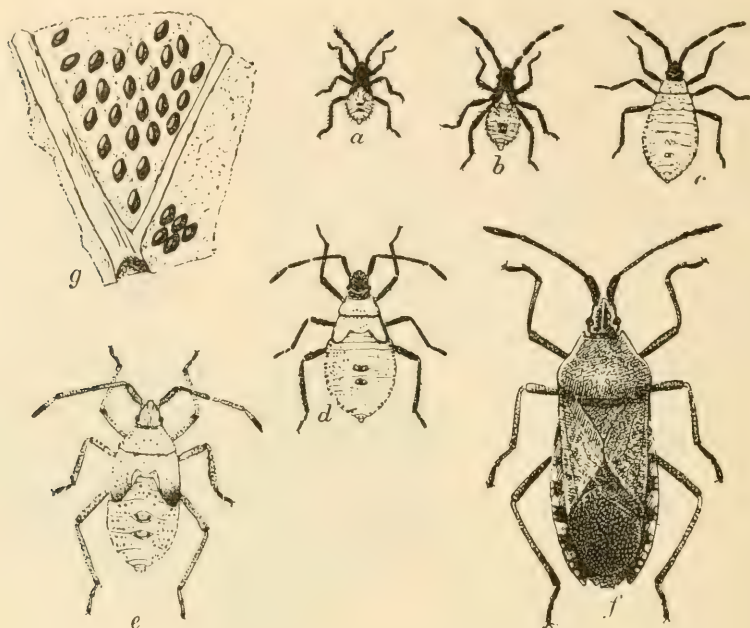


FIG. 26.—The common squash bug: *a, b, c, d, e*, partly grown young; *f*, full-grown bug; *g*, eggs. Enlarged.

Treatment.—When the borers attack cucumbers, it is almost impossible to kill them without killing the plants. The borers may be cut out of squash vines by slitting the stems of the vines lengthwise. After making the slit, portions of the vines should be covered. Help the plant to grow extra roots by covering damaged stems with earth. Keep the plants growing vigorously, and free from other insects and diseases.

Prevention.—Plant early squash for a trap. Harrow the garden lightly in the fall, and plow deeply in the spring to keep the moths from coming out. The dead vines and old plants should be destroyed as soon as the crop is gathered.

ONIONS

SMUT.—*S m u t* causes the young onion plants to die back. The dead leaves are covered with pimples full of black powder. The disease lives over winter in the soil.

Treatment.—There is no successful remedy for sick plants.

Prevention.—Plant onions on land where

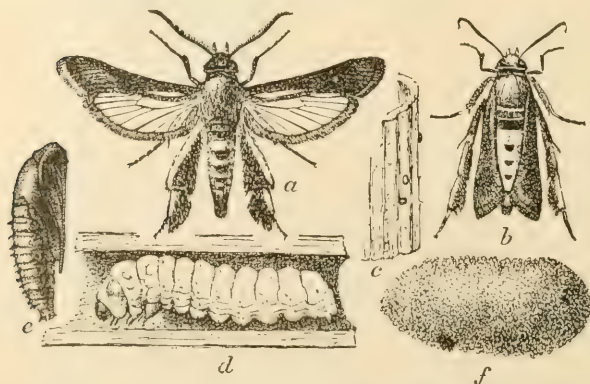


FIG. 27.—Squash-vine borer: *a*, moth with wings spread; *b*, moth at rest; *c*, egg on section of vine; *d*, caterpillar or grub in squash vine; *e*, chrysalis; *f*, chrysalis cell from ground. Enlarged one-third.

the disease has not occurred. If this cannot be done, sprinkle formaldehyde solution (1 teaspoonful to 1 quart of water) in the drill after the seeds have been dropped and before covering, using 3 to 4 quarts of the solution to each 100 feet of row.

ONION THRIPS.—The onion thrips is a very small insect, often incorrectly called the onion louse, which causes the injury known as white blast, white blight, or silvertop. It also causes scallions or thick-necks. This insect often ruins entire fields of onions. It also attacks cauliflower, cabbage, cucumbers, melons, pumpkins, squashes, parsley, tomatoes, kale, turnips, and seed beets.

Treatment.—Nicotine sulphate (see page 29) is used with success.

ONION MAGGOT.—The onion maggot (fig. 28) is the worst northern onion pest. It eats into the bulb, starting decay, and often destroys the whole onion. The onion maggot is the larva of a small gray fly, which looks like a small house fly. Two or three broods may be looked for each year.

Treatment.—The best remedy known is a poisoned bait to attract and kill the flies. The bait is made as follows:

Sodium arsenate.....	1 level teaspoonful
Water	1 gallon
Cheap molasses	1 pint

Dissolve the sodium arsenate in boiling water, and add the molasses. Since it is not necessary to cover the leaves, the bait may be put on in large drops by shaking from a whisk broom dipped into a bucket of the poison. It should be applied when the flies are first seen.

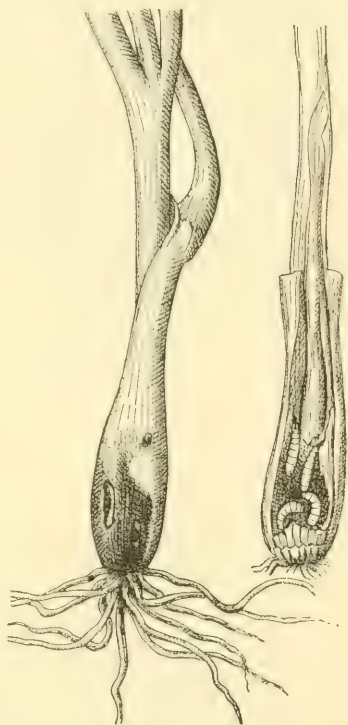


FIG. 28.—Young onion plant, showing onion maggots at work in the bulb; at right, plant exposed slightly, showing the same.

PEAS

POD SPOT.—This disease gets its name from the round or irregular dark spots which it causes on the pods. It also makes spots on the leaves and dark, sunken places on the stems; often there are dark spots on the seeds from diseased pods. The disease is carried over from one year to the next upon such diseased seed.

Treatment.—There is no effective treatment for the growing crop.

Prevention.—Save seeds from unspotted pods. Plant only healthy seeds free from spots. Plant in a different part of the garden each year.

PEA WEEVIL.—Seed peas are often found with a single round hole in each, due to attack by the pea weevil or pea "bug." This insect is about $\frac{1}{4}$ inch long and is thickly covered with brownish fuzz with black and

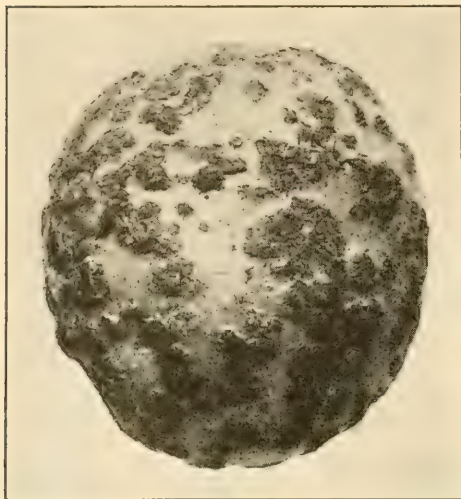


FIG. 29.—Scab on potato. Unfit for planting.

plant seeds that have been injured by weevils.

FOUR-SPOTTED BEAN WEEVIL AND COWPEA WEEVIL.—The four-spotted bean weevil and the cowpea weevil look much alike. While both like cowpeas as food, they also live on table beans in the South,

white markings. Often every pea in a pod when prepared for the table will be found infested with a weevil. In dry seed the hollowed out place under the skin in which the insect lives can be seen plainly. Many seeds that have been attacked will start to grow, but the plants are likely to be weak. Since this weevil has only one brood a year, it is treated more easily than is the bean or cowpea weevil.

Prevention.—If you raise your own seed, keep it in a warm room in a tight bag or box for one full season before planting. The weevils will come out of the seed so kept and die. Do not

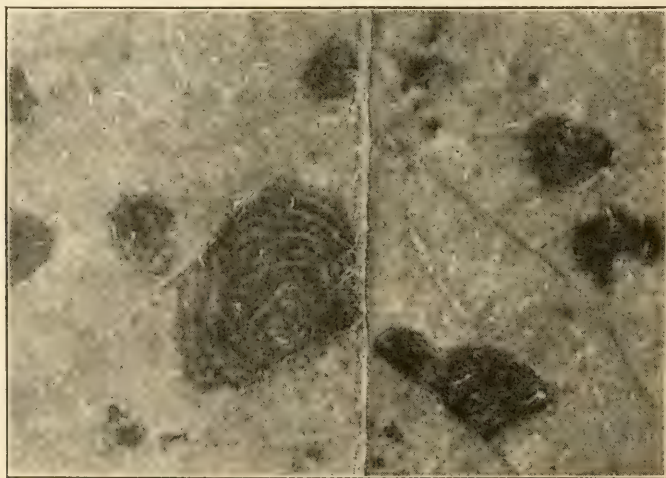


FIG. 30.—Spots of early-blight on potato leaf.

and peas, chick-peas and, in fact, all such seeds large enough for them to grow in. They differ from the true pea weevil in that they have several broods each year on dry seeds.

Treatment.—Fumigate with carbon disulphid (see page 30), or if the

CARBON disulphid is explosive, and club members should use it only under the direction of the club leader or parents.

seed are not to be used for planting, place in a shallow pan and bake in an oven for 5 to 10 minutes.

PEA APHIS.—The pea aphid is one of the largest of the plant-lice, being about one-eighth of an inch long. It is pea green, the same as its food plant. Attack begins upon the young vine, the lice gathering in clusters about the tips. Later they attack the stem and suck out the life of the plant.

Treatment.—Nicotine sulphate (see page 29) and kerosene soap emulsion (see page 29) are good remedies if used when the insects first begin to attack the plants in early spring.

The plant-lice can also be beaten off the vines on to the ground. This can best be done with a brush of small twigs or a pine bough with the leaves left on. On a warm, sunny day the lice are killed by the hot ground on which they fall and few, if any, ever get back to the plants.

This aphid also feeds on clover, alfalfa, field peas, and several weeds.



FIG. 31.—Potato leaves with dead spots due to late-blight.



FIG. 32.—Potato tuber rotted by late blight.

POTATO

SCAB.—This trouble causes roughened brownish spots or scabs on the skin of the potatoes (fig. 29). In severe cases the whole potato may be covered with these spots. The trouble lives in the soil and is carried on the scabby potatoes.

Treatment.—The control of this disease is entirely preventive.

Prevention.—Do not plant scabby seed. Do



FIG. 33.—Tip burn of potato leaves due to hot, dry weather.

killed in a few days. Later, it produces a brown rotting of the tubers (fig. 32), which continues after the potatoes have been put into the cellar.

Treatment.—Late-blight can be controlled by carefully spraying the plants with Bordeaux mixture (see page 27) the same as for early-blight. This disease is more serious than early-blight and to control it the plants must be kept covered all the time with a coating of the spray mixture, which must be put on with a good sprayer which gives a fine misty spray. Potatoes showing rot at digging time should not be put in the cellar with the good potatoes. For planting, select only sound potatoes, since the disease lives over winter in diseased potatoes.

TIP BURN.—In dry, hot weather the tips and edges of the potato leaves often curl up, turn brown, and die (fig. 33) from lack of water and too hot sun.

Treatment.—Spraying with Bordeaux mixture (see page 27), as for early-blight, will help to prevent this trouble.

WILT.—This disease causes a yellowing and slow wilting of the plants and reduces the yield. The disease causes a browning of the stem end of the potatoes (fig. 34).

not use lime, fresh stable manure, or wood ashes for fertilizer. Plant on new land where scab has not been found before. If troubled with the disease, soak the seed potatoes, just before cutting, for 15 minutes in a solution of 1 teaspoonful formaldehyde in 1 quart of water (see page 28).

EARLY-BLIGHT.—In the Northern States, this trouble usually comes in early July. It causes dark, roundish spots on the leaves, which have ridges or rings (fig. 30). It is worse in moist, warm weather.

Treatment.—Spray plants with Bordeaux mixture (see page 27), beginning when the disease is first seen. Repeat the spraying every 10 to 14 days in dry weather and every 7 days in moist weather to the end of the season.

LATE-BLIGHT.—In the Northern States, this disease is the cause of great losses in years when cool, moist weather occurs during August. It causes dark, irregular dead spots on the leaves (fig. 31) and stems, and spreads very fast. In favorable weather, the plants may be



FIG. 34.—Potato stem-end browning due to wilt. Not fit to plant.

Treatment.—There is no remedy for sick plants.

Prevention.—Diseased seed potatoes should not be used, because in this way the trouble is carried to the plants. Do not plant on land where the disease was bad the year before.

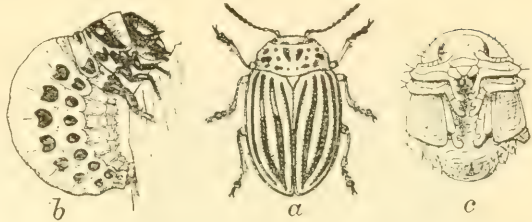


FIG. 35.—Colorado potato beetle: a, beetle; b, slug; c, pupa.

COLORADO POTATO BEETLE.—If careful watch is not kept, this insect (fig. 35) is sure to injure the crop. The beetle and its slugs, the young or larva, are so well known that no description is necessary. Both slugs and beetles feed on the potato plants. After passing the winter in the ground, the beetles appear about the time the

potatoes come up, lay their eggs on the under sides of the leaves, and start feeding. They often destroy small patches grown for garden purposes. The beetles sometimes feed also on eggplants and tomatoes. There are from one to three broods a year.

Treatment.—Arsenate of lead is the best remedy. Use as described on page 28.

BLISTER BEETLES.—Blister beetles rank next to the Colorado potato beetle as potato pests. They are slim, somewhat soft-bodied insects of different colors, sometimes striped, that feed on all kinds of vegetables, seeming to prefer potatoes, after which they attack beans, peas, beets, cabbage and other plants. They are sometimes called "old-fashioned potato bugs."

Treatment.—Lead arsenate is the best remedy, mixed and put on as recommended on page 28.

FLEA-BEETLES.—Small round holes in the leaves of the potatoes and various related crops, such as tomatoes and eggplants, show the presence of flea-beetles.

Treatment.—Lead arsenate (see p. 28) put on as a spray is the best remedy, especially if stirred into Bordeaux mixture. Bordeaux mixture (see p. 27) alone is an excellent spray to drive the beetles away. Spray both sides of the leaves.



FIG. 36.—Sweet potato slips showing black-rot should not be set in the field.

SWEET POTATOES

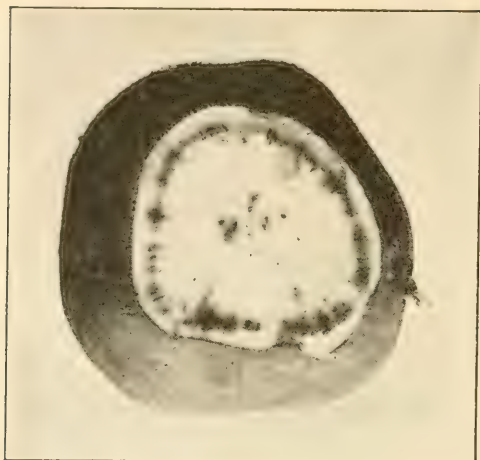


FIG. 37.—End of sweet potato showing black ring caused by stem-rot.

BLACK-ROT.—This widespread disease causes roundish, black, sunken spots on the potatoes. Diseased slips in the hotbeds show black spots on the stems (fig. 36, p. 23) or they may rot off and die soon after being set out. Blackrotted potatoes have a bitter taste when cooked.

Treatment.—There is no effective treatment for sick plants.

Prevention.—To prevent black-rot, use fresh soil in the hotbeds. Select only smooth, sound potatoes for

bedding and discard all diseased slips. Plant next year in a part of the garden where sweet potatoes have not been grown for several years.

STEM-ROT.—The stem-rot occurs nearly everywhere sweet potatoes are grown. It is first indicated by the yellowing of the leaves, after which the plant gradually wilts and dies. Stems from diseased plants are black inside and the potatoes show a black ring (fig. 37).

Treatment.—None.

Prevention.—To prevent this disease, select seed for planting at digging time and only from healthy plants. If the plant stem is black inside, save no seed from that hill. For growing slips, follow directions for prevention given under black-rot above.

FOOT-ROT.—This disease shows first about mid-summer as small brown or black spots on the stems near the ground. These spots grow larger and become covered with many tiny black pimples. Finally they girdle the stems and the plants die.

Treatment.—None.

Prevention.—To prevent foot-rot, plant only healthy slips in a part of the garden not before in sweet potatoes. Follow directions for growing slips given under black-rot prevention above.

TORTOISE BEETLES.—There are several kinds of small beetles (fig. 38) which feed on sweet potato, and which are shaped much like turtles.

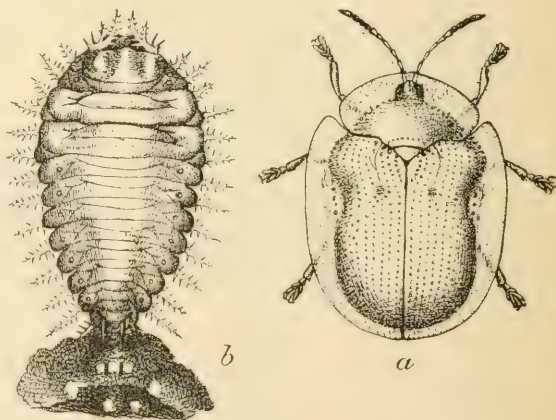


FIG. 38.—The golden tortoise beetle: *a*, beetle; *b*, young. Greatly enlarged.

They are usually golden, marked with black. They and their young eat the leaves. The young are peculiar, spiny grubs with long forked tails which they carry over their backs loaded with dirt for protection.

Treatment.—The grower need not spray for these pests unless they become serious. Use arsenate of lead (page 28).

FLEA-BEETLES.—These are little, black, shiny beetles that hop about like fleas. They may not be seen unless looked for carefully. They cut long slits into the leaves or eat them full of small holes.

Treatment.—Spray with arsenate of lead as directed on page 28.



FIG. 39.—Tomato leaf-spot causes many small dark spots on the leaves, which turn yellow, curl up, and drop off.

TOMATO

LEAF-SPOT.—This disease causes many small dark spots with white centers on the tomato leaves (fig. 39). The bottom leaves are attacked first and soon turn yellow, curl up, and drop off. The disease is quite common and is usually first seen when the plants are about half grown.

Treatment.—Thorough spraying with Bordeaux mixture (see page 27) will hold the disease in check. Begin spraying as soon as the plants are set in the garden and repeat every ten days.

Prevention.—Grow plants in a different part of the garden each year.

WILT.—In some States tomatoes are attacked by a wilt disease which prevents the plants from getting water. Plants so attacked wilt and die suddenly without any apparent reason.

Treatment.—None.

Prevention.—Destroy diseased plants. Use new land for tomatoes the next year. Several excellent varieties of tomatoes resistant to this disease have been bred by the United States Department of Agriculture.

BLOSSOM-END ROT.—This disease causes large, dark, rotten spots on the blossom end of the green fruits (fig. 40, p. 26).

Treatment.—Watering the plants during very dry weather has been found helpful in controlling the trouble.

TOMATO WORMS OR HORNWORMS.—These large green caterpillars are also called tobacco hornworms or tobacco worms as they feed on both

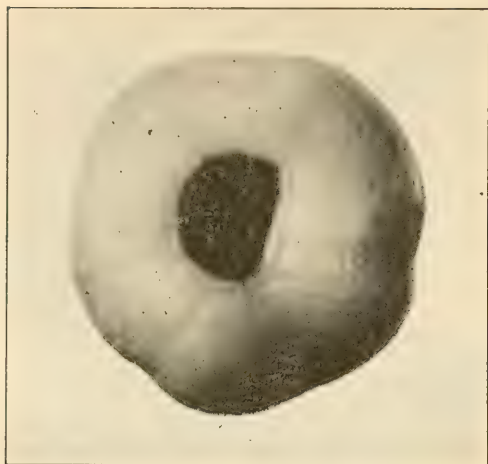


FIG. 40.—Tomato blossom-end rot.

worms when they are not moving since they are of the same color as the stems on which they rest during the day. They may often be discovered by their voidings. When feeding they are more readily seen and can be easily killed. A single dose of lead arsenate (see page 28) will kill them.

Tomato worms will often be found that have many little white cases on their backs. These are not the eggs of the caterpillar, as it does not lay eggs. They are cases or cocoons from which come little wasps that sting and kill tomato hornworms. Do not kill hornworms that are carrying these cases, as the wasps will be killed also.

TOMATO FRUITWORM.—The tomato fruitworm (fig. 42), also called the corn earworm, is the cause of much trouble to tomato growers as it eats into the ripening fruit and destroys it.

Treatment.—Lead arsenate (see page 28) put on two or three times will keep the insect partially under control. As long as sweet corn is nearby, the worms will let the tomatoes alone. Hand picking is good in small gardens.

FLEA-BEETLES.—The potato flea-beetle frequently attacks tomatoes and does much damage.

Treatment.—Dip the young plants in a lead-arsenate solution (3 ounces of lead-arsenate paste in 1 gallon of water) before setting them out. Spraying with Bordeaux mixture (see page 27) will drive the beetles away.

these plants (fig 41). They are the young of large humming bird moths and have a wicked looking horn on the tail. The worms are harmless to persons and so need not be feared. There are two broods in a season. When the worms become full grown they may cut all the leaves from the tomato plants. The gardener should be on the lookout for the first as well as the second brood.

Treatment.—Hand picking is the best remedy, but it takes sharp eyes to see the

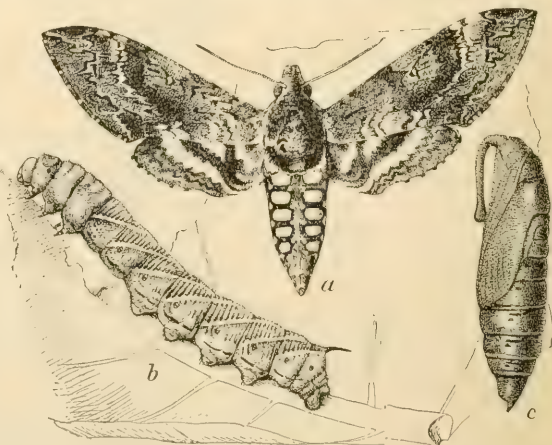


FIG. 41.—Tomato hornworm: a, moth; b, hornworm; c, chrysalis.

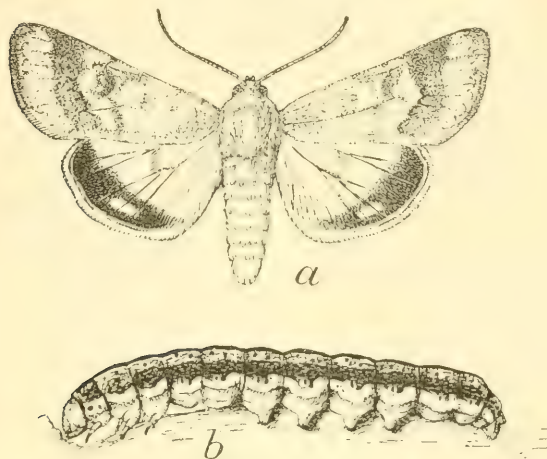


FIG. 42.—Tomato fruitworm: a, full-grown moth; b, fruit worm.

HOW TO MAKE FUNGICIDES AND INSECTICIDES

Fungicides are materials used to kill germs or molds which cause plant diseases.

Insecticides are materials used to kill insects which attack plants.

BECAUSE of the danger of poisoning from careless handling of these materials, it is desirable that the club leader or some adult be present when the solutions are made. This is especially true of lead-arsenate, paris green, and arsenic.

FUNGICIDES

BORDEAUX MIXTURE.—This is one of the best spray mixtures for controlling leaf diseases of garden plants. Since Bordeaux helps keep the diseases off the plants it is very important that it should be applied before they appear or as soon as they are seen. It can be bought in paste or dust form from seed dealers, or a better spray can be made at home, as follows:

Bluestone (copper sulphate).....	1 ounce
Quicklime (stone lime).....	1 ounce
Water.....	3 quarts

Dissolve the bluestone in $1\frac{1}{2}$ quarts of hot water in a wooden or earthenware pail. Slake the lime in a small quantity of water, then add enough more to make $1\frac{1}{2}$ quarts. Pour the bluestone and lime solutions together, straining them through a fine cheesecloth or brass wire strainer, and mix thoroughly. The mixture is Bordeaux. It should be made fresh each time used, as it is not good when old.

Since stone lime air slakes rapidly and is then no longer good for Bordeaux, it is best to make up a stock solution of lime containing 1 pound of lime to each gallon of water. This will keep a long time.

A stock solution of bluestone can be made by dissolving 1 pound of the bluestone crystals in a gallon of water. A half pint of each of these stock lime and bluestone solutions will take the place of an ounce of lime and bluestone given in the formula. Dilute each with water as directed above before mixing. By adding 1 ounce of lead-arsenate paste or $\frac{1}{2}$ ounce of powdered lead-arsenate to Bordeaux, the mixture made is useful for killing insects as well as controlling diseases.

FORMALDEHYDE.—Formalin. This chemical is used to make a solution for soaking potatoes, seeds, and soil to kill disease germs. Use 1 teaspoonful to 1 quart of water or 1 ounce to 2 gallons of water. Formaldehyde looks like water and causes the eyes to smart, but is not poisonous.

INSECTICIDES

Two kinds of insecticides are used for controlling insects, stomach poisons and contact poisons.

Stomach poisons, such as lead and lime arsenate, and paris green, are used for all insects which injure plants by chewing the leaves or stems, like striped cucumber beetles and potato beetles.

Contact poisons, such as kerosene emulsion and nicotine sulphate,

which kill by touching the insects, are used for sucking insects like plant lice and squash bugs. Stomach poisons are of no value for sucking insects.

LEAD-ARSENATE.

Lead-arsenate is sold by most druggists and seedsmen both as a powder and as a paste. It is a good remedy for nearly all kinds of pests which eat the leaves of garden plants. It is used either mixed with water as a spray or as a dry powder dusted on plants.

How to make the spray.

—Take 1 level teaspoonful of powdered lead-

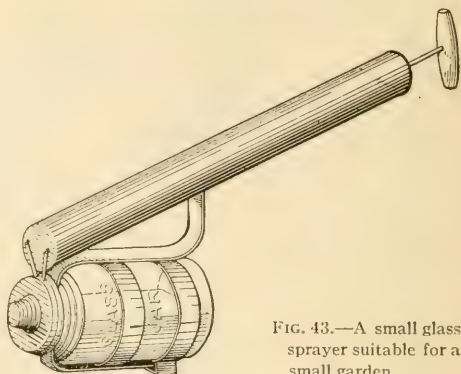


FIG. 43.—A small glass sprayer suitable for a small garden.



FIG. 44.—A compressed-air sprayer suitable for larger gardens and small fruit trees.

arsenate for each pint of water. Mix thoroughly and apply with sprayer. If lead-arsenate paste is used, take 2 teaspoonfuls for each pint of water to make a spray mixture.

How to mix dust poison.—Where a sprayer is not available, a dust may be used. This is made by thoroughly mixing 1 pound of powdered lead arsenate with 3 pounds of air slaked or powdered lime. This mixture is put into a cheesecloth bag and dusted onto the plants by shaking the bag lightly over them.

OTHER STOMACH POISONS, such as arsenate of lime and arsenate of zinc may also be bought from dealers. These are used like lead-arsenate, either in paste or powdered form. Directions for making the mixtures will be found on the packages.

NICOTINE SULPHATE.—For small gardens use a teaspoonful of nicotine sulphate in a gallon of water. A 1-inch cube of hard soap should be shaved up and thoroughly mixed into the solution. Full directions for mixing are given on the covers of the packages. For large insects like the pea aphid, a little more nicotine sulphate than stated above should be used. By looking carefully at the newly sprayed plants, one can tell whether there is enough soap in the mixture. If the spray draws together in drops, more soap should be added. When possible, resin fish-oil soap should be used, but cheap laundry soap will do. If the nicotine sulphate solution has stood for any length of time, it should be mixed thoroughly before using. The insects themselves must be wet by the spray or they will not be killed. Therefore, the spraying should be very thorough, and should be done as soon as the insects are noticed.

KEROSENE EMULSION.—Several kinds of kerosene emulsion can be bought in the stores already mixed, so it is hardly worth while to make it at home for the small garden.

SOAP SPRAYS.—Ordinary soapsuds is a good spray mixture for plant-lice and leafhoppers. It should be made by dissolving a 1-inch cube of laundry soap or a rounded tablespoonful of whale-oil or fish-oil soap in a quart of hot water. This also must reach the bodies of the insects to kill them. This spray must not be used full strength on very tender plants, such as young cabbage or cauliflower in seed beds, garden peas, or young beans, as it will injure the leaves. Use one-half strength for these plants.

LIME.—Lime is used to control cabbage clubroot, but it is liable to increase scab on potatoes. It acts at the same time to keep away certain insects such as maggots and grubs and is a good remedy for slugs. Air-slaked lime or hydrated lime is the best form to use.

FLOWERS OF SULPHUR.—For the control of the red spider and for some other kinds of mites, sulphur may be either dusted on plants or mixed with water, a teaspoonful of sulphur to a quart of water, and sprayed.

HOW TO SPRAY

To do good work in killing insects and keeping diseases from the plants, spraying must be done in time. Do not wait until the plants have been harmed beyond help, but begin work as soon as the trouble

is noticed. Use good apparatus and spray carefully, since careless spraying merely wastes the mixture. Using a watering pot or whisk-broom is not spraying and will not save the plants.

The spray should come from the nozzle in a mist so fine that it floats for some time in the air. This gives a better and finer coat of poison to the leaves and reaches many more insects.

Do not use too much of the mixture on the plants. After spraying, the leaves should be wet, but not dripping. If it drips from the leaves, it is being wasted. If a compressed-air sprayer is used, pump it up tight and keep it so.

It is better to spray with Bordeaux mixture before a rain, rather than after, if the mixture has time to dry before the rain begins. Dust sticks much better if put on after a rain, or when the dew is on in the morning.

ALWAYS clean the sprayer well, inside and out, after using it. Unless this is done it may rust out in a few weeks.

SPRAYING AND DUSTING TOOLS.—The sprays and dusts described may be put on in many ways. For the small garden, an atomizer sprayer (fig. 43) is good, but a compressed-air sprayer is better for gardens of medium size (fig. 44).

In the case of the atomizer sprayer, the container for the liquid should be made of glass or brass, as Bordeaux mixture and other materials eat tin and iron. These sprayers cost from 50 to 75 cents. Compressed-air sprayers of galvanized steel may be bought for \$3.50 to \$5.00, and for \$6.50 to \$12.50 if made of brass.

Dusts may be easily applied by shaking them from a fine cheesecloth bag or from a can with a handle with the bottom perforated with small holes. There are also several cheap dust guns on the market.

MISCELLANEOUS CONTROL METHODS

SOIL TREATMENT.—Young plants grown in flats or boxes for setting in the garden are often troubled with such diseases as damping-off (page 5), and clubroot (page 10), which attack the roots and stems of the plants. These troubles live in the soil and the best way to get rid of them is to drench the soil with boiling water a few days before planting the seeds. Set the box of soil over the sink and pour the boiling water into it as fast as the soil will take it up. Use 9 quarts of water for a box 1 foot square with soil 4 inches deep. When the soil has dried out enough, plant the seeds. Seeds in this soil will sprout better and the plants grow faster and stronger than in diseased soil.

CARBON DISULPHID.—Carbon disulphid is a clear yellowish liquid with a bad smell. It is used for treating seeds and to kill weevils and other insects which breed in seeds. A tin bucket or can, fitted with an air-tight top, makes a good fumigator. The seed should be placed in the bucket or can and the carbon disulphid poured onto a piece of rag or waste cotton and dropped upon the seed. A teaspoonful of carbon

disulphid is sufficient for a 1-gallon can or bucket. The lid should then be fitted tightly onto the can or bucket and left on for 24 hours. The seed should then be removed and aired.

CARBON DISULPHID is a dangerous explosive when brought near fire. If you wish to fumigate with it, ask your parent or leader to show you how.

TRAP CROPS.—Some garden insects which feed on several kinds of plants prefer one kind so much that they will leave the other plants and gather on the favorite. This habit can often be taken advantage of to protect garden crops. For example, a row of radishes may be planted next to cabbages to attract the cabbage maggot. Tomatoes and beans may be protected from the corn earworm by a few hills of early corn near the garden. A crop planted in this way to protect another by attracting the insect pests from it, is called a trap crop.

INSECT FRIENDS

LADYBIRD BEETLE.—Not all of the insects found on the garden plants damage the crop, as anyone will soon see who closely watches a ladybird

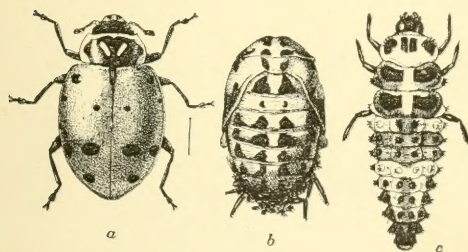


FIG. 45.—A ladybird: *a*, beetle; *b*, pupa; *c*, young. These beetles and their young eat dozens of plant-lice each day.

beetle (fig. 45) or its peculiar red and bluish young when in a group of plant-lice. Ladybirds, so well known to most gardeners, are among the grower's best friends. One of them has been known to eat more than 80 plant lice in a day. Save all of these little red and black helpers that you can.

SYRPHUS FLY.—Another friend that feeds on plant-lice

is the curious green maggot often found among them. This is the young of a small yellow black-banded fly (fig. 46) that may be found about "lousy" plants. This is known as a syrphus fly and should be protected.

There are many other friendly insects, such as ground-beetles, lace-wing flies, and tachina flies. If it were not for these, pests would increase so fast that there would soon be no vegetables left to feed them.

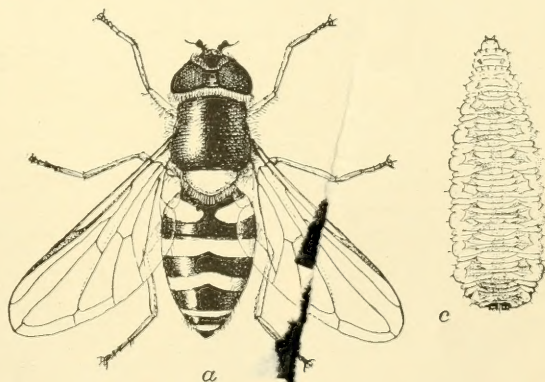


FIG. 46.—A syrphus fly: *a*, fly, *c*, maggot. This fly helps keep down plant-lice. It is about the size of a common house fly.



0 022 265 900 0



121
11